MONTANA POPULATION PROJECTIONS, 1980-2000

FOR COUNTIES AND INCORPORATED CITIES AND TOWNS

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FOREWORD

Old mathematical models never die; they are reborn in new and more useful models, christened with the inevitable new set of acronyms. The MASS model, with which this study and report are concerned, is an illustration of the principle. In its genealogy appear such names as ATOM, developed for the Arizona economy and modified for use in Wyoming; the Utah Process which was the work of economists in and for that state; and the unpronounceable MFP which is its immediate forerunner.

MFP -- the Montana Futures Process -- and a major share of the design of MASS which allowed the regional projections of MFP to become county-specific, were the work of economists Bruce Finnie and Jerry Fleming, formerly with the Division of Research and Information Systems. Refinement and modification of the system was done by Phillip Brooks, who wrote this report describing a specific application of the model. And since complex models of this nature depend on computer technology, as well as Economics, Econometrics, and Demography, programming and systems design assistance were furnished by Dana Glatz, who prepared the User's Guide for this study.

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CHAPTER 1

INTRODUCTION

1.1 Background

The Montana Water Quality Management Plan, more often referred to as the state's "208 Planning Project", takes its impetus from section 208 of the Federal Water Pollution Control Act Amendments of 1972. Like the larger project comprehended by the Pollution Control Act, the Montana planning project is ambitious, proposing as it does to formulate by 1983 a plan to locate and bring under control all the sources of stream pollution in the state. Responsibility for developing this plan for over half the state's area not included in the four so-called "designated areas", falls to the Department of Health and Environmental Sciences, and its Water Quality Bureau.

It was recognized early in the formulation of the work plan for this project that all the so-called "point" sources of pollution and most of the much more extensive non-point sources, now and in the future, are and will be the result of human activities of one kind or another. It therefore becomes necessary, if a workable control plan is to be developed, to peer into the future and, as accurately as possible, make projections of the future size and distribution of Montana's population. This report deals with the process and the results of the effort by the Division of Research and Information Systems, Montana Department of Community Affairs, to develop such a set of projections.

1.2 Purpose of the Report

Most population predictions turn out to be wrong; and the longer the period comprehended and the smaller the geographical area, the larger the

errors become. It may be said, in fact, without much danger of contradiction that all "naive projections" -- the mere mechanical extension of trend lines established in the past -- are doomed.

This report describes the development of an alternative method with considerably better chances of success. It involves an economic-demographic projection model based on the principle that economic activity, specifically employment, is the basis of population migration which is by far the largest component of population change in Montana and surrounding states. The other component, natural increase, is handled by the model based on currently available statistics on birth and death rates in the state, furnished by the Department of Health, and on survival rates by age-group or "cohort" established on a national basis. The model was developed to provide projections of population by county; but the requirements of the 208 planning project called for estimates of the future behavior of population numbers by cities and towns within counties. To provide this further breakdown of the projections, a procedure (see Appendix B) was developed to allocate the county population figures to cities and towns based on their projected trends in the proportion of the county population.

1.3 Organization of the Report

In the next chapter of this report, the analytical framework for the projections outlined above is presented in considerably greater detail. It is designated the Montana Alternative Simulation System, with the acronym MASS used to refer to the model.

The county projections yielded by the MASS model are presented in chapter 3, by five year intervals to the year 2,000.

These population projections are not the first, and certainly not the

last ones, to be made for the State of Montana. In chapter 4, a comparison is made with the state level projections prepared by the Bureau of Economic Analysis, U. S. Department of Commerce and known as the OBERS projections (1977 version). The latter projections are being used for the 208 planning process in states which have not developed alternative projections considered to be more realistic than the OBERS numbers.

Appendix A presents what has been designated a User's Manual, to guide researchers in other agencies that may want to make use of the MASS model. Appendix B, which has already been referred to, takes the county projections presented in chapter 3 and allocates a portion to each of the 126 incorporated cities and towns in the state, for each of the future years to the year 2000 used in the county projections.

CHAPTER 2

ANALYTICAL FRAMEWORK FOR PROJECTIONS

This chapter discusses the use of MASS (Montana Alternative Simulation System) in projecting population for all 56 Montana counties to the year 2000. A summary of MASS is first presented. This is followed by a more specific discussion of the natural increase demographic model (cohort-survival model), the economic model, and the final population projection methods.

2.1 Summary of the Construction of the Montana Alternative Simulation System[1]

The Montana Alternative Simulation System (MASS) is a computerized economic-demographic model designed to serve as a tool in the quantitative appraisal of the economic and demographic impact of a wide range of external events at the county level. The main goal of the system is to produce a consistent set of county level employment and population projections, as well as to provide a general framework for evaluating the impacts of industrial developments. MASS combines trend, economic base analysis and a population cohort-survival process into a complementary whole, thus avoiding the divergent forecasts of employment and population that commonly result from independent forecasting methods. The principal advantage of MASS lies in its ability to produce at relatively low cost, in both time and resources, projections of population and the impact of economic events. However, as with any model or information source, the outputs of MASS must be considered only a part of the analysis rather than

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[1] This section draws heavily on a previously published summary document, "Montana Alternative Simulation System", by Bruce Finnie, Research and Information Systems Division, Department of Community Affairs, Helena, Montana, March, 1977.

an end product.

The first step in the construction of MASS was the formulation of the natural increase demographic model (cohort model). This model used age specific Montana birth information, adjusted projected national survival rates by age and sex, adjusted Montana labor force participation rates (percent of a population group in the labor force) and employment-to-labor force ratios to project natural increase population and employment to the year 2000. This natural increase projection is an estimate reflecting no net migration. The analysis included special computational procedures for Indian, military and college student sub-populations.

The next step was the classification of employment sectors into two groups: basic and non-basic. Basic industries are those whose employment levels are determined by factors outside the areas of interest; in this case, the specific Montana county. Examples include agriculture and metal mining. Basic sectors also directly or indirectly export products outside the area being studied, and hence bring income into the region. On the other hand, non-basic industries such as the local government sector serve local needs. In addition, many sectors represent a mixture of basic and non-basic activity. All sectors for Montana counties were categorized as basic, non-basic, or some combination of the two. Every available information source was used in this process.

Once the basic sectors were identified, projections of basic employment levels by sector and county were made. These projections were principally time trends adjusted using documented planned employment expansions and contractions and other information concerning the growth of a county's basic industries. Basic employment projections drive the entire MASS system.

The next step involved computing the ratios of non-basic-to-basic employment in each county for the period of 1970-1975. Data from this period, as

well as other time periods and areas, indicate that these ratios or multipliers vary signficantly over time and generally increase.

There are several factors behind this increase. First, personal income has increased, both in Montana and nationally, causing the demand for products of non-basic sectors to increase. Public and private services are more and more substituted for activities once provided in the home. At the same time, the supply of workers available for non-basic type jobs has increased as the "baby boom" babies reached employment age, and because of the increasing tendency of women to participate in the labor force outside the home.

The above factors were incorporated into the procedure for projecting a statewide non-basic-to-basic ratio. This ratio was calculated as a function of the weighted average of projected age-sex specific labor force participation rates, using the estimated natural increase population of the cohort model by age and sex as weights. Changes in the state multiplier were assumed to hold at the county level and were used to adjust the county ratios over time.

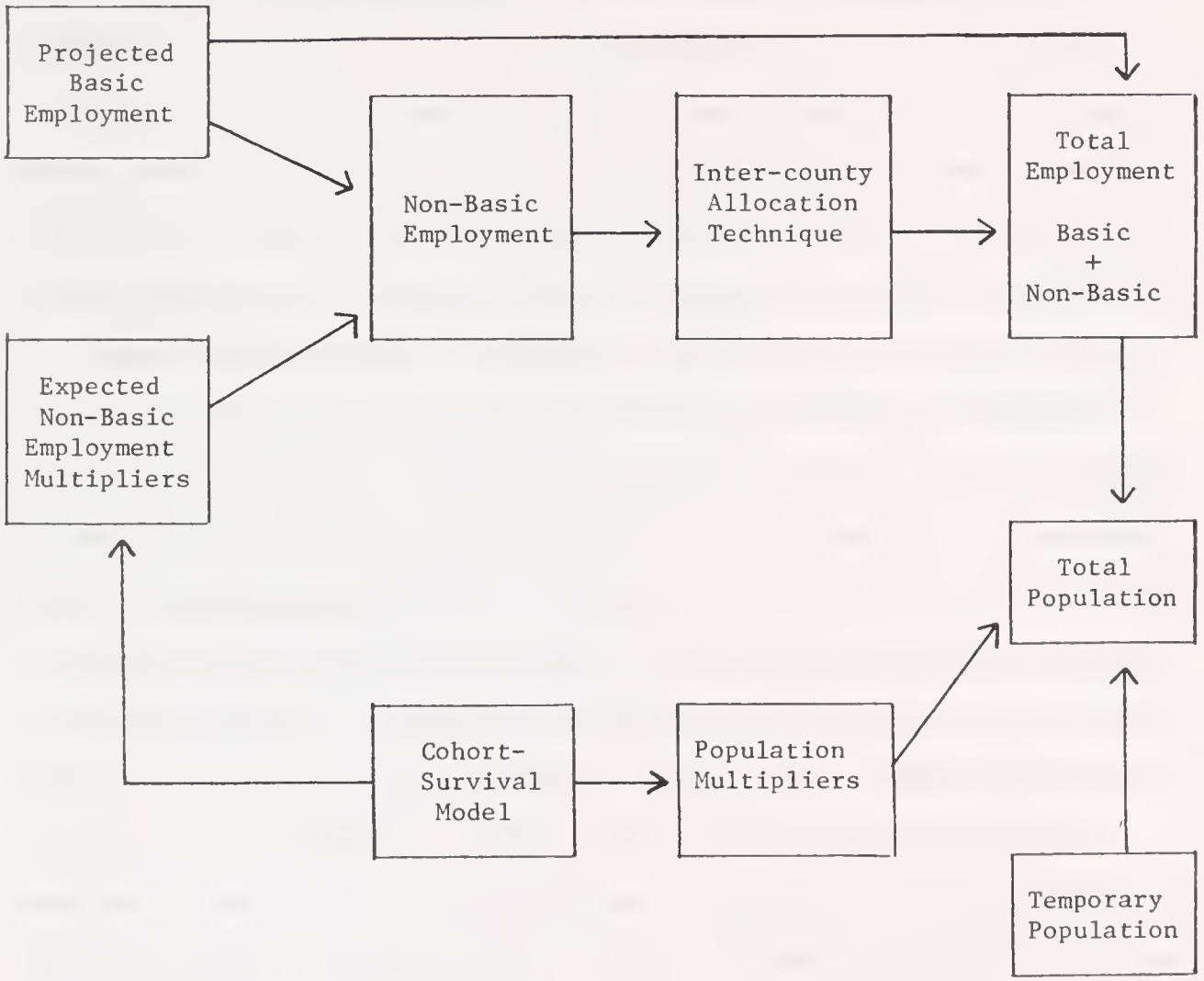
Non-basic employment by county was estimated by applying non-basic multipliers to county level basic employment projections. As part of this process, a mathematical programming-gravity model was used to quantify inter-county linkages between basic and non-basic employment. This resulted in a county percentage distribution or allocation of non-basic employment related to basic employment in a given county. The allocation technique was confined to two of the five broadly defined types of non-basic sectors.

The next major link in the system required the development of a set of projected population multipliers. These population-to-employment ratios were derived from the cohort-survival model. These multipliers change over time for the same reasons which contributed to the general growth in non-basic/basic

ratios.

The estimated population multipliers were applied to projected total employment (basic and non-basic) to derive projections of population by county. These were then adjusted for population levels associated with major temporary construction projects and for non-employment related population growth.

The overall structure of the MASS model is summarized in the following diagram.



2.2 Cohort-Survival Model

The cohort-survival model used was a county adaptation of a similar multi-county model that was a part of the now defunct Montana Futures Process (MFP) analytical system. The cohort model started with base year population, broken down by age and sex, applied fertility and survival rates to calculate births and deaths, and then "aged" each cohort or age group one year. This process was repeated over the entire projection period.

Special population groups, namely Indians, the military, and college students, were treated separately. Indian specific vital rates were used to estimate a natural increase Indian population, while the age-sex distributions for military and college student populations were assumed constant over the projection period, once their total levels had been estimated.[2] The three sub-populations were then combined with the rest of the population to produce an age-sex specific estimate of population in each Montana county due to "natural increase".

As was indicated in Section 2.1, the cohort model was also used to estimate the possible employment level due to a natural increase in population, in absence of net migration. This was accomplished in two steps. First, projected labor force participation rates were applied to the population projections to derive an estimate of the natural increase labor force. Natural increase employment was then computed as the product employment/labor force ratios and the projected labor force numbers.

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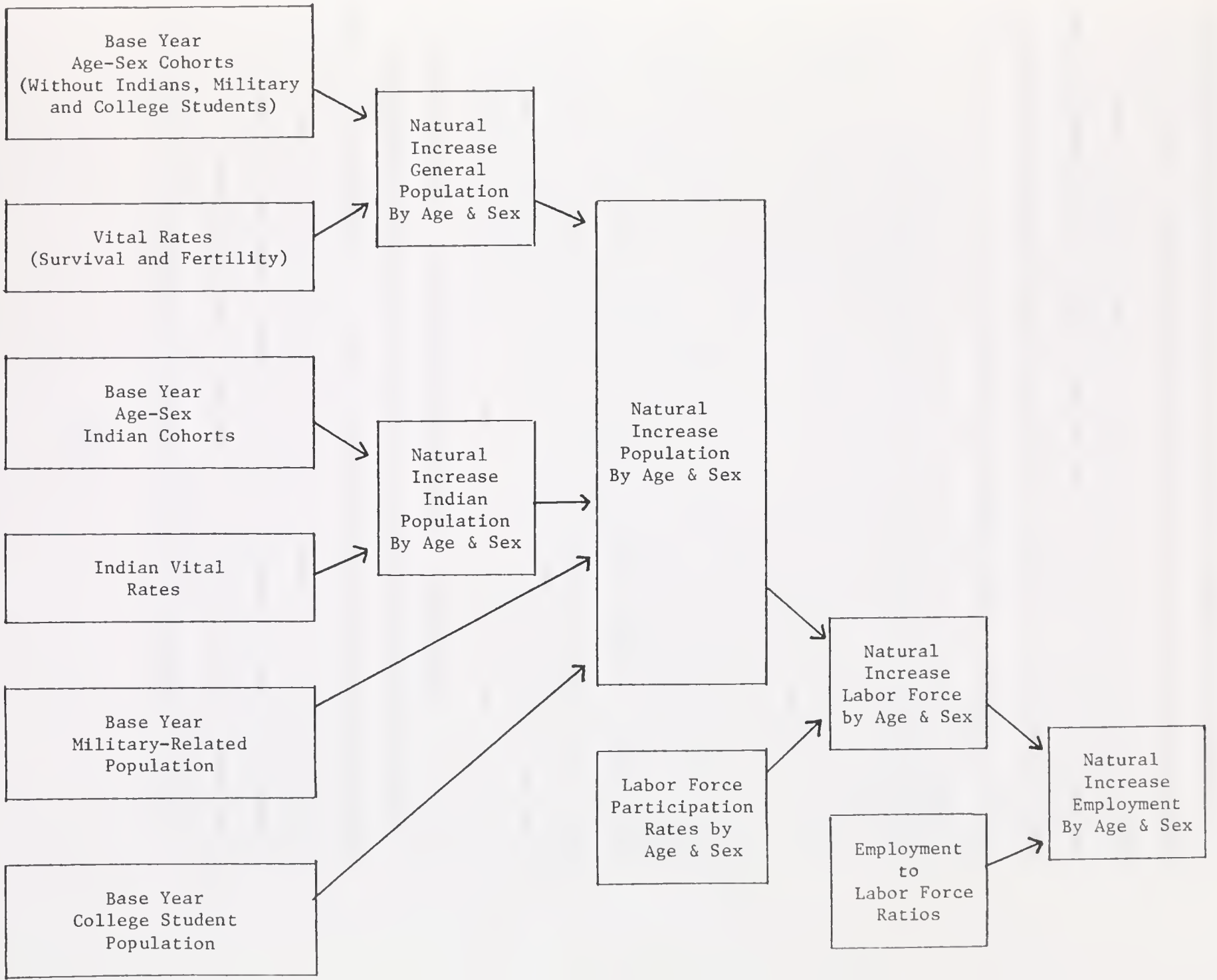
[2] Research and Information Systems Division, Montana Department of Community Affairs, The Montana Futures Process: Final Report to the Old West Regional Commission (Helena, Montana: Department of Community Affairs, June, 1976) Appendix III.

The natural increase population and employment projections were used in other parts of MASS. Specifically, they were used to help project the changing levels of non-basic-to-basic ratios, and population multipliers.

The overall structure of the cohort model is summarized in the following diagram.


Base Year
Age-Sex Cohorts
(Without Indians, Military
and College Students)
Vital Rates
(Survival and Fertility)
Natural
Increase
General
Population
By Age & Sex
Base Year
Age-Sex
Indian Cohorts
Indian Vital
Rates
Natural
Increase
Indian
Population
By Age & Sex
Base Year
Military-Related
Population
Base Year
College Student
Population
Natural
Increase
Population
By Age & Sex
Labor Force
Participation
Rates by
Age & Sex
Natural
Increase
Labor Force
by Age & Sex
Employment
to
Labor Force
Ratios
Natural
Increase
Employment
By Age & Sex

2.2.1 Estimation of the Natural Increase Population

The core of the cohort model were the procedures for estimating the population level that would naturally occur without net migration. As mentioned above, three population groups were treated separately in the process, i.e., Indians, the military population, and college students. The rationale for this separation was that these groups have unique demographic characteristics and behavior as compared with the general population.

2.2.1-1 Estimation of Natural Increase for the General Population

The first step in the estimation of natural increase for the general population was the removal of special population groups from the general population for the base year 1970. Several procedures were used to accomplish this removal. In the case of Indians, data on population levels by age and sex were available from the 1970 Census of Population. Since Malmstrom Air Force Base is the only major military installation in Montana, only Cascade County was adjusted for military-related population. Data on the 1970 level and age/sex distribution of military personnel and their families was obtained from Malmstrom Air Force Base. Information on the 1970 college student population was obtained from enrollment records of the two state universities and the three Montana state colleges. These records indicated the number of students by class (freshman, sophomore, etc.) and by sex. The age distribution was computed using an estimate of average age by class. Adjustments to the general population because of college students were then made for Beaverhead, Gallatin, Missoula, Hill, and Yellowstone counties. Students associated with smaller public and private colleges were not included in the computations.

Once an estimate of the 1970 general population without the three special

population groups had been computed, each age/sex cohort (ages 0,1,2.....85+) was "aged" one year by multiplying each group by its projected survival rate. This rate is defined as one minus the death rate and indicates the probability of a person of a given cohort surviving to the succeeding year. For example, the number of males twenty-five years of age multiplied by the corresponding survival rate for twenty-five year old males, yields the number of twenty-six year old males at the beginning of the following period.

The next step in the projection process involved estimating the number of births expected to occur during the year and adding them to the survived population. This was accomplished by multiplying the number of females in each age cohort between fifteen and forty-five years of age by that group's fertility rate, the probability of a woman in the given cohort having a live birth. The births for each female age group were then summed to get total births expected during the year and were divided into sex classifications using the base year's percentages of females and males. After births were added to the previously survived population as a new zero age-sex cohort, the entire process of surviving the cohorts and adding births was repeated each year until the end of the projection period.

2.2.1-2 Estimation of Natural Increase for Special Populations

As mentioned above, three population groups, namely Indians, military, and college students were treated separately in the projection process. The natural growth of the Indian population was computed in basically the same way as the general population. The only difference involved using Indian specific survival and fertility rates. The level and age/sex distribution of the military-related and student population groups were assumed to remain constant over the

thirty year projection period (1970-2000). The rationale for this assumption was that these two population groups exhibit such high turnover that, though the people change, the characteristics of the population do not.[3]

2.2.2 Estimation of Natural Increase Labor Force and Employment

The possible labor force and employment levels due to natural demographic forces in absence of net migration, was estimated after natural increase population projections had been computed. This estimation was accomplished by first applying projected age/sex specific labor force participation rates (the percent of the population available for work) to the natural increase population cohorts. The result was an estimate of the available labor force (assuming no net migration). Employment-to-labor force ratios were then applied to projected labor force levels to arrive at an estimated natural increase employment level by age and sex. The employment numbers were summed over all age-sex groups to derive a total employment figure for each county, and for each year in the projection period. These represented employment levels that would occur as a result of natural demographic change. The natural increase employment and population figures were used later in the analysis to help derive and adjust employment and population multipliers over time.

2.3 Economic Model

The economic model portion of MASS used economic base theory as a foundation. As mentioned above (Section 2.1), the economic base of an area consists of those economic activities whose levels are determined by factors outside of the area. According to this conceptual framework, these "basic" activities

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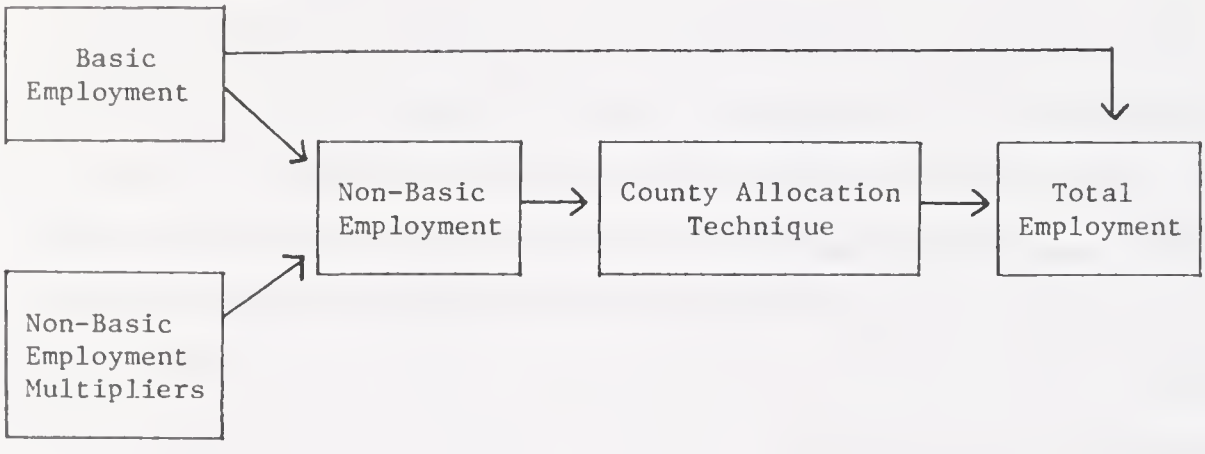
[3] Ibid.

are the primary driving force behind economic change for the region. The level of activity in the other non-basic sectors is assumed to be derived from "basic" activity.

Economic activity can be measured in either income or employment terms, or some combination of the two. Employment was used for MASS primarily because of the problems associated with measuring Montana county farm proprietor's income. This is both the most difficult component of income to estimate and the most important part of total income for a majority of Montana counties.

The components of the economic base model are summarized in the following diagram and are discussed in detail below.



2.3.1 Basic Employment

Basic employment was projected in a series of steps. Sectors were first classified as basic, non-basic or some combination. A time trend employment projection for defined basic sectors was next made, and then adjusted using additional information and analysis.

A number of information sources were used in identifying basic sectors.

For example, tourism survey data were used to help separate the basic components of the retail trade and service sectors from the non-basic. Administrative records were employed to determine excessively high concentrations of state government employment in certain counties. Similarly, the employment associated with large-scale construction projects (dams, highways, etc.) was assumed to be basic activity. State and national location quotients (ratios showing the relative concentration of specific county industries) were frequently utilized as an aid for this entire process, but the final determination was based primarily on a familiarity with the county in question.

The next step in estimating basic employment involved a first-cut projection of the level of basic employment by sector and county. This projection was based on the historical trends of the data for the 1970-1975 period.

The final step involved adjusting the projected sector/county specific employment levels in a careful, but sometimes subjective, way. This was necessitated in part by the short time series (1970-75) used in the trend projections. Sometimes an unusually low or high employment level for one year of the historical period made the trend line implausible. This was true for the agricultural sector for most counties, for instance. More ad hoc computational methods were then used to establish a projected basic employment level. At other times, documented planned expansions or contractions of employment in a county's basic industries were used to adjust the original projected levels of employment.

2.3.2 Non-Basic Employment Multipliers

Non-basic employment multipliers by county and by five broadly-defined sector classes were projected on the basis of their computed 1975 value (the

last year of the "actual" employment data base) and the projected change in an equivalent statewide ratio. These statewide sector specific ratios in turn represented allocated values of a projected overall Montana non-basic multiplier. The overall multiplier was estimated using projected statewide natural increase employment-to-population ratios available from the cohort model.

2.3.3 Inter-County Allocation of Non-Basic Employment

After non-basic employment was computed by county as the product of total basic employment and the five sector specific non-basic multipliers, part of this non-basic employment was allocated to other counties. This allocation used 1975 intercounty linkage coefficients estimated by a mathematical programming and gravity model technique.[4]

Several steps were involved in the determination of base-year linkage coefficients. First, an average expected non-basic employment figure was derived for two of the five types of non-basic sectors for every county. These figures were computed as the product of 1975 basic employment for a given county times the statewide non-basic employment multiplier. This was used to represent an estimated demand for non-basic services. Second, "actual" 1975 county level non-basic employment numbers were used to represent supply. Next, a 56 x 56 mileage matrix showing distances between the largest cities in each county was constructed. Fourth, the ratios of county base year (1975) population to these distances raised to the fourth power[5] for all possible county

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[4] Mathematical programming techniques are optimizing procedures of maximizing or minimizing some factor or group of factors subject to a series of constraints. Gravity models deal with the interaction among masses (areas in this context).

[5] This exponent worked the best.

combinations were computed. These ratios were then used to determine the most likely county suppliers of non-basic services. Using a simultaneous iterative mathematical programming procedure, a percentage distribution for county suppliers (linkage coefficients) was derived for each county for the two types of non-basic activities.

Once linkage percentages were computed, they were applied to projected non-basic employment in order to distribute this employment among counties where appropriate. This allocation technique was confined to only the two types of non-basic sectors where inter-county linkages were judged most important.[6]

2.3.4 Total Employment

The determination of total employment was the last step in the economic model computations. Total employment was simply computed as the sum of projected basic and non-basic employment for every county in the state.

2.4 Projection of Population

Once total employment had been computed, population by county was projected using population multipliers (ratios of population to employment) derived from the cohort model and 1975 county employment and population data. Special multipliers were computed for counties that in the recent past experienced substantial non-employment related population growth. Also, the temporary population associated with identified major construction projects was treated separately.

In most cases, population multipliers were computed by first forming the

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[6] The first type of non-basic sectors were: Retail Trade, Services, and Non-Farm Proprietors. The second group were: Wholesale Trade; Finance, Insurance, and Real Estate; Printing and Publishing; Transportation (except Railroads); and the Federal Civilian Employment Sector.

ratio of 1975 population and employment for each county. These ratios were then adjusted over the projection period using estimated natural increase population and employment numbers available from the cohort model.

A few Montana counties have experienced substantial population growth since 1970 not closely related to growth in employment in those counties. The apparent reason for this phenomenon was workers living in one county and working in an adjacent county. For these few "bedroom" counties population multipliers were not derived in the manner indicated above. Instead, multipliers were estimated based on the county growth rate of population-to-employment ratios for the period of 1970-1975. The projected population growth of the relevant adjacent county was also considered in this analysis.

The population associated with temporary construction projects presented another special estimation problem. Historical data indicated that the secondary or non-basic employment impact of temporary construction (basic) employment was minimal in Montana counties. Because of this, the population effects of temporary construction employment were added separately to the estimate of the more permanent population, as the last step in the projection of population. The level of temporary population was estimated as the product of the number of workers in identified future temporary construction projects, and an appropriate population multiplier specific to construction workers. This level of temporary population was then added to the "permanent" population to derive the estimate of total population.

CHAPTER 3

PROJECTIONS

This chapter contains information concerning the projections produced by the MASS system. Both employment and population projections are included. In addition, principal data inputs and assumptions used in MASS to help produce the projections are discussed.

3.1 Principal Data Inputs and Assumptions for the Cohort Model

As was described in Section 2.2, the cohort-survival model projected natural increase population and employment by county (assuming no net migration). There were four main data series used in these projections: 1970 population, birth rates, survival rates, and labor force participation rates.

County specific population by age and sex was available from the 1970 Census of Population.[1] These data were by single year of age. They served as the starting point for the natural increase projections.

Two types of fertility rate data series were used in the cohort model. First, statewide base year fertility rates were constructed and used as points of departure. These rates were derived from unpublished birth information available from the Montana Department of Health and Environmental Sciences, and 1970 Census of Population data for females ages 15 through 45. Table 3.1 presents the computed Montana fertility rates for both Indians and non-Indians. The second data series consisted of national fertility rate projections constructed by the Bureau of the Census.[2] Montana non-Indian fertility rates were assumed

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[1] Second count tape obtained from the Bureau of the Census.

[2] U. S. Bureau of the Census, Current Population Reports, Series P-25, No. 601, "Projections of the Population of the United States: 1975 to 2050", (Washington, D. C.: U. S. Government Printing Office, 1975), p. 126.

TABLE 3.1

MONTANA FERTILITY RATES
(per 1000 women)

Age	Non-Indian	Indian
15	6.15	24.40
16	23.09	79.85
17	49.42	143.39
18	105.85	220.50
19	199.92	334.55
20	208.88	342.63
21	233.34	322.77
22	230.24	355.26
23	199.67	305.31
24	220.00	297.80
25	181.51	256.01
26	166.82	240.08
27	143.56	184.43
28	135.88	167.50
29	111.63	187.76
30	90.89	137.06
31	73.95	154.00
32	73.18	142.25
33	56.77	104.05
34	49.71	120.00
35	37.92	62.93
36	37.74	60.61
37	29.43	53.17
38	26.83	75.52
39	20.20	49.65
40	15.68	33.73
41	10.01	27.78
42	8.03	19.32
43	6.25	13.89
44	3.37	2.58
45	2.43	3.37

Source: Derived from 1970 Census of Population information and unpublished birth data available from the Bureau of Records, Montana Department of Health and Environmental Sciences.

to converge with "Series I" national projections in 1990 and coincide with the national pattern after that date. Indian fertility rates were assumed to parallel national rates throughout the projections period.[3]

The survival rates used in the natural increase population projections were national figures for 1972 trended to an ultimate rate for the year 2000. Differences between Montana and U. S. rates are minimal.[4] The 1972 and ultimate (2000) rates are presented in Table 3.2. Each entry in this table shows the probability of a person of a given age and sex surviving one year. As can bee seen from Table 3.2, survival rates were projected by the Bureau of the Census to change very little.

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[3] Montana Department of Community Affairs, The Montana Futures Process, Appendix III.

[4] Ibid.

TABLE 3.2

U. S. SURVIVAL RATES AND PROJECTIONS: 1972 AND 2000,

By Age and Sex

Age	1972		2000	
	Male	Female	Male	Female
0	.997328	.997870	.998127	.998529
1	.998850	.999069	.999047	.999243
2	.999265	.999405	.999047	.999243
3	.999417	.999528	.999517	.999616
4	.999484	.999589	.999566	.999663
5	.999493	.999613	.999562	.999676
6	.999506	.999636	.999563	.999690
7	.999538	.999660	.999586	.999708
8	.999595	.999688	.999635	.999732
9	.999662	.999717	.999698	.999759
10	.999708	.999737	.999743	.999779
11	.999686	.999736	.999724	.999781
12	.999556	.999702	.999601	.999753
13	.999321	.999636	.999378	.999698
14	.999029	.999552	.999100	.999626
15	.998734	.999464	.998823	.999551
16	.998472	.999389	.998579	.999490
17	.998260	.999339	.998391	.999454
18	.998110	.999315	.998267	.999443
19	.997987	.999303	.998172	.999445
20	.997861	.999286	.998077	.999444
21	.997769	.999270	.998013	.999440
22	.997756	.999260	.998021	.999438
23	.997815	.999255	.998095	.999435
24	.997917	.999251	.998209	.999432
25	.998026	.999246	.998329	.999427
26	.998106	.999228	.998426	.999415
27	.998135	.999188	.998479	.999388
28	.998106	.999126	.998483	.999348
29	.998041	.999047	.998456	.999295
30	.997967	.998961	.998421	.999235
31	.997888	.998873	.998379	.999172
32	.997802	.998786	.998325	.999110
33	.997707	.998702	.998257	.999048
34	.997595	.998612	.998170	.998981
35	.997455	.998509	.998057	.998903
36	.997281	.998391	.997914	.998807
37	.997068	.998255	.997742	.998688
38	.996813	.998100	.997536	.998545
39	.996519	.997930	.997298	.998383
40	.996190	.997745	.997027	.998207
41	.995822	.997540	.996714	.998020
42	.995413	.997309	.996350	.997821
43	.994961	.997052	.995935	.997610

TABLE 3.2 - Continued

U. S. SURVIVAL RATES AND PROJECTIONS: 1975 and 2000

Age	1972		2000	
	Male	Female	Male	Female
44	.994463	.996771	.995469	.997384
45	.993918	.996469	.994956	.997140
46	.993319	.996155	.994405	.996882
47	.992663	.995833	.993821	.996611
48	.991945	.995503	.993202	.996327
49	.991166	.995155	.992539	.996027
50	.990326	.994780	.991819	.995705
51	.989414	.994376	.991016	.995357
52	.988421	.993940	.990108	.994981
53	.987341	.993469	.989090	.994574
54	.986180	.992967	.987972	.994136
55	.984940	.992433	.986771	.993667
56	.983599	.991850	.985496	.993169
57	.982132	.991200	.984147	.992642
58	.980530	.990485	.982719	.992085
59	.978809	.989687	.981213	.991476
60	.976982	.988809	.979611	.990801
61	.975031	.987924	.977835	.990091
62	.972930	.987102	.975802	.989377
63	.970669	.986329	.973497	.988648
64	.968251	.985550	.970967	.987869
65	.965680	.984671	.968380	.986991
66	.962947	.983545	.965468	.985935
67	.960037	.982045	.962545	.984630
68	.956936	.980133	.959515	.983048
69	.953626	.977919	.956325	.981246
70	.950086	.975521	.952914	.979272
71	.946291	.972896	.949282	.977075
72	.942215	.969956	.945442	.974574
73	.937827	.966680	.941374	.971743
74	.933083	.963197	.937031	.968635
75	.927938	.959250	.932361	.965277
76	.922381	.954973	.927329	.961501
77	.916406	.950107	.921904	.957105
78	.909981	.944589	.916041	.952019
79	.902910	.938407	.909613	.946319
80	.894996	.931598	.902501	.940106
81	.886413	.924273	.894788	.933330
82	.877506	.916551	.886638	.925881
83	.868417	.908462	.878095	.917708
84 and over	.814702	.849132	.824272	.855543

Source: U. S. Bureau of the Census, Current Population Reports, Series P-25, No. 601, "Projections of the Population of the United States: 1975 to 2050", (Washington, D. C.: U. S. Government Printing Office, 1975), p. 133.

County specific labor force participation rates were used in the cohort model to help project labor force and employment levels associated with natural demographic forces. Detailed county labor force participation rates by age and sex were available from the 1970 Census.[5] These were converged to projected equivalent national rates for 1990 and held constant at that level for the remainder of the projection period. The national projections were constructed by the Bureau of Labor Statistics, U. S. Department of Labor and are presented in Table 3.3.

[5] U. S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Montana, PC (1)-C28, (Washington, D. C.: U. S. Government Printing Office, 1971), Table 121.

TABLE 3.3

NATIONAL CIVILIAN LABOR FORCE PARTICIPATION RATES
(percent of population in labor force)

Sex and Age Group	Actual		Projected		
	1970	1975	1980	1985	1990
MEN					
Total, 16 years and over	79.3	77.8	77.8	77.5	77.3
16 and 17 years	46.6	48.6	50.6	50.7	50.8
18 and 19 years	64.6	70.7	71.8	71.4	71.4
20 to 24 years	82.8	84.4	84.2	83.0	82.1
25 to 34 years	96.6	95.1	95.2	94.9	94.7
35 to 44 years	96.6	95.7	95.5	95.1	94.8
45 to 54 years	94.2	92.0	91.2	90.6	90.2
55 to 64 years	81.8	75.7	74.3	71.6	69.9
65 years and over	26.9	21.7	19.9	18.0	16.8
WOMEN					
Total, 16 years and over	43.0	46.3	48.4	50.3	51.4
16 and 17 years	34.9	40.2	43.1	45.4	56.9
18 and 19 years	52.0	58.1	60.0	61.5	62.5
20 to 24 years	57.4	64.0	68.4	72.5	75.2
25 to 34 years	44.8	54.5	57.4	61.2	63.5
35 to 44 years	50.7	55.9	58.3	61.1	63.0
45 to 54 years	54.4	54.6	57.1	59.1	60.3
55 to 64 years	42.5	41.0	41.9	42.2	42.3
65 years and over	9.6	8.2	8.1	7.8	7.6

Source: Howard N. Fullerton, Jr., and Paul O. Flain, "New Labor Force Projections to 1990", Monthly Labor Review, Vol. 99, No. 12, December 1976, p. 5.

3.2 Principal Data Inputs and Assumptions for the Economic Model

The major inputs and assumptions of the economic model consisted of the classification of sectors into basic and non-basic categories and the projections of basic employment by sector and county. Non-basic sectors were also broken down into five groups.

3.2.1 Classification of Basic and Non-Basic Sectors

As was discussed in Section 2.3.1, a number of information sources were used in identifying basic sectors. This process resulted in twelve industries being classified as basic for every county, with portions of all other sectors being basic, the exact proportion depending on the county in question. The basic/non-basic, classification scheme is presented in Table 3.4. The mixed basic/non-basic sectors were further grouped into five categories in connection with estimating non-basic employment, using group specific multipliers. These groups were defined as follows:

1. Retail Trade, Services, and Non-Farm Proprietors.
2. Printing and Publishing; Other Transportation; Wholesale Trade; Finance, Insurance, and Real Estate; and Federal-Civilian.
3. General Construction, Heavy Construction, Special Trade Construction.
4. Utilities and Communications.
5. State and Local Government.

Non-basic employment for the first two categories was also allocated among counties using the methods described in Section 2.3.3.

3.2.2 Data Sources and Assumptions for the Projection of Basic Employment

As was mentioned in Section 2.3.2, basic employment projections were de-

TABLE 3.4

SECTOR CLASSIFICATION SCHEME

BASIC	MIXED BASIC/NON-BASIC
Agriculture	General Construction
Metal Mining	Heavy Construction
Oil and Gas Extraction	Special Trade Construction
Coal and Other Mining	Printing and Publishing
Lumber and Wood Products	Other Transportation
Primary Metals Processing	Utilities and Communication
Other Durable Goods Manufacturing *	Wholesale Trade
Food Processing	Retail Trade
Petroleum Refining	Finance, Insurance, and Real Estate
Other Non-Durable Goods Processing **	Services
Railroad Transportation	Federal-Civilian
Federal-Military	State and Local Government
	Non-Farm Proprietors ***

Source: Derived

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* Other Durable Goods Manufacturing consists of Furniture and Fixtures; Fabricated Metal Products; Machinery, except Electrical; Electric and Electronic Equipment; Transportation Equipment; Ordnance; Stone, Clay, and Glass Products; Instruments and Related Products; and Miscellaneous Manufacturing Industries.

** Other Non-Durable Goods Processing includes Textile Mill Products, Apparel and Other Fabricated Textile Mill Products, Paper and Allied Products, Chemicals and Related Products, Rubber and Miscellaneous Plastic Products, Leather and Leather Products.

*** Non-Farm Proprietors consists of all non-agricultural self-employment persons, including independent professional practitioners and entrepreneurs in non-farm businesses. This separate category is required because of data limitations.

rived from a time trend of employment by basic sector and county,[6] modified with other information. Sometimes this information was obtained from published documents. The documents included a study of the supply of crude petroleum to Montana, and several economic-demographic projection reports for counties in southeastern Montana.[7] Other unpublished sources were also used. In addition, for some cases, the trend projections were modified more judgmentally to eliminate projections that exploded into extremely high or low (sometimes negative) levels. These adjustments were made most often for sectors with volatile employment levels.

3.3 Total Employment Projections

As was described in Section 2.3, once basic employment by sector and county had been projected, non-basic employment by county was estimated using a series of multipliers and an inter-county allocation technique. Total employment was then computed as the sum of basic and non-basic employment for each county. Table 3.5 presents total employment projections by county for the 1980-2000 time period.

An analysis of Table 3.5 leads to several conclusions. First, most of the projected employment growth was in Montana's more "urban" counties.[8] In fact,

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[6] Historical employment data was obtained from the Regional Economic Information System (REIS), Bureau of Economic Analysis, U. S. Department of Commerce.

[7] Paul E. Polzin, "Proposals to Supply Petroleum and Natural Gas to Montana", Montana Business Quarterly, Volume 15, No. 3 (Summer 1977), pp. 3-12; Mountain West Research, Inc., Economic Demographic Study of the Five County Mid-Yellowstone Areawide Planning Organization: Final Report, (Billings, Montana: Mountain West Research, Inc., 1977); Mountain West Research, Inc., Technical Documentation for the MYAPO Economic Demographic Projections Model, (Billings, Montana: Mountain West Research, Inc., 1977); Mountain West Research, Inc., Rosebud County, Montana: Economic-Demographic Analysis Baseline and Projections 1976-1990 (Billings, Montana: Mountain West Research, Inc., 1976); and Mountain West Research, Inc., Rosebud County, Montana: Economic Demographic Analysis Baseline and Projections 1976-1990, Update (Billings, Montana: Mountain West Research, Inc., 1977).

[8] Cascade, Flathead, Gallatin, Lewis and Clark, Missoula, Silver Bow, and Yellowstone.

TABLE 3.5

MONTANA COUNTY EMPLOYMENT PROJECTIONS: 1980 - 2000
(rounded to nearest 100)

COUNTY	1980	1985	1990	1995	2000
Beaverhead	3,300	3,400	3,400	3,400	3,500
Big Horn *	4,400	4,700	5,100	5,300	5,700
Blaine	2,800	2,900	2,900	2,900	3,000
Broadwater	1,400	1,400	1,400	1,400	1,500
Carbon	3,800	3,900	4,100	4,400	4,700
Carter	900	900	800	800	800
Cascade	38,900	40,600	42,300	43,900	45,400
Chouteau	3,000	3,000	3,000	3,000	2,900
Custer	6,600	6,800	6,900	7,000	7,100
Daniels	1,700	1,700	2,200	2,100	2,100
Dawson	5,600	5,700	5,700	5,700	5,700
Deer Lodge	5,900	6,000	6,000	6,100	6,200
Fallon	1,900	1,900	1,900	1,900	2,000
Fergus	5,700	5,800	6,000	6,100	6,200
Flathead	19,500	21,000	22,200	23,500	24,800
Gallatin	16,500	18,300	19,700	20,900	22,300
Garfield	900	900	900	900	900
Glacier	4,500	4,700	4,900	5,100	5,400
Golden Valley	400	400	400	400	400
Granite	1,100	1,200	1,200	1,300	1,300
Hill	8,300	8,600	8,800	9,000	9,300
Jefferson	1,800	1,800	1,800	1,700	1,700
Judith Basin	1,200	1,200	1,200	1,100	1,100
Lake	5,400	5,500	5,500	5,500	5,600
Lewis & Clark	20,000	21,300	22,600	23,700	25,100
Liberty	1,200	1,100	1,100	1,100	1,100
Lincoln *	6,800	6,800	7,000	7,200	6,900
McCone	1,600	1,500	1,500	1,500	1,500
Madison	2,400	2,400	2,400	2,400	2,400
Meagher	900	900	900	900	1,000
Mineral	1,500	1,600	1,600	1,600	1,700
Missoula	29,200	31,500	33,500	35,600	38,000
Musselshell	1,800	1,900	2,000	2,100	2,200
Park	5,200	5,400	5,600	5,700	5,900
Petroleum	300	300	300	300	200
Phillips	2,300	2,300	2,300	2,200	2,200
Pondera	2,800	2,800	2,800	2,800	2,800
Powder River	1,300	1,300	1,300	1,300	1,300
Powell	3,100	3,300	3,500	3,600	3,800
Prairie	1,000	1,000	900	900	900

TABLE 3.5 - Continued

MONTANA COUNTY EMPLOYMENT PROJECTIONS: 1980 - 2000
(rounded to nearest 100)

COUNTY	1980	1985	1990	1995	2000
Ravalli	6,000	6,200	6,400	6,600	6,800
Richland	5,200	5,300	5,400	5,400	5,600
Roosevelt	5,100	5,300	5,500	5,700	5,900
Rosebud	4,600	5,000	5,000	5,000	5,000
Sanders	3,700	3,900	4,100	4,400	4,600
Sheridan	2,900	2,900	3,000	3,000	3,100
Silver Bow	15,600	15,900	16,200	16,500	16,800
Stillwater *	2,200	2,200	2,900	2,900	2,900
Sweet Grass *	1,700	1,600	1,900	1,900	1,900
Teton	2,600	2,600	2,600	2,500	2,500
Toole	3,100	3,200	3,300	3,400	3,500
Treasure	500	500	500	500	500
Valley	5,600	5,500	5,500	5,400	5,400
Wheatland	1,300	1,300	1,200	1,200	1,200
Wibaux	700	700	600	600	600
Yellowstone	52,200	58,700	64,800	70,600	77,300
TOTAL	341,300	358,500	376,500	391,900	410,200

Source: Derived

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* Total employment includes temporary construction workers. Employment without construction workers is as follows: Big Horn - 4,200 (1980), 4,600 (1985), 5,000 (1985); Lincoln - 6,200 (1980); Stillwater - 2,200 (1985); and Sweet Grass - 1,600 (1985).

these counties accounted for nearly 90 percent of the employment growth between 1980 and 2000. Second, most of the small counties (under 3000 employment) showed either no growth or slight employment decreases. Modest incremental growth was projected for nearly all of the remaining medium-sized counties.

3.4 Population Projections

As described in Section 2.4, population was projected by applying population multipliers (ratios of population to employment) to employment projections. The multipliers generally were derived by using 1975 ratios of population to employment for each county and adjusting these ratios over time with natural increase population and employment numbers available from the cohort model. For a few counties where the direction of projected multipliers did not fit recent historical experience, additional adjustments were made. Also, the population associated with identified major temporary construction projects was estimated separately.

Table 3.6 presents county population-to-employment ratios for the 1980-2000 projection period. A preponderance of county multipliers decreased over time, reflecting slower natural population growth relative to natural increase employment. This was caused primarily by increasing labor force participation (see Table 3.3). However, estimated multipliers for several counties increased over the projection period., i.e., natural-increase population was projected to go up faster than employment. The apparent cause for this was that the initial 1970 age/sex distributions for these counties showed either proportionately more females or younger age cohorts than the state average. Both factors would tend to cause higher population figures for later years.

Population multipliers for Big Horn, Carbon, Flathead, Lake, Ravalli, and

TABLE 3.6

MONTANA COUNTY POPULATION MULTIPLIERS: 1980 - 2000

COUNTY	1980	1985	1990	1995	2000
Beaverhead	2.49	2.46	2.42	2.40	2.38
Big Horn	2.63	2.63	2.63	2.63	2.63
Blaine	2.37	2.29	2.24	2.21	2.14
Broadwater	2.24	2.18	2.15	2.11	2.07
Carbon	2.35	2.35	2.35	2.35	2.35
Carter	2.02	2.03	2.03	2.01	2.02
Cascade	2.20	2.19	2.20	2.22	2.23
Chouteau	2.07	2.07	2.03	2.00	1.95
Custer	2.00	1.98	1.96	1.97	1.96
Daniels	1.81	1.76	1.73	1.69	1.63
Dawson	1.99	1.99	1.98	2.01	2.04
Deer Lodge	2.30	2.23	2.13	2.06	1.98
Fallon	2.14	2.13	2.10	2.12	2.12
Fergus	2.33	2.27	2.21	2.20	2.18
Flathead	2.50	2.50	2.50	2.50	2.50
Gallatin	2.43	2.39	2.35	2.34	2.32
Garfield	1.88	1.89	1.89	1.86	1.81
Glacier	2.48	2.39	2.34	2.31	2.26
Golden Valley	2.35	2.34	2.30	2.25	2.23
Granite	2.45	2.37	2.31	2.23	2.12
Hill	2.19	2.18	2.17	2.19	2.18
Jefferson *					
Judith Basic	2.23	2.17	2.07	2.00	1.92
Lake	3.31	3.38	3.44	3.51	3.58
Lewis & Clark	2.05	2.10	2.16	2.22	2.29
Liberty	2.17	2.14	2.09	2.08	2.06
Lincoln	2.68	2.65	2.60	2.58	2.55
McCone	1.68	1.66	1.63	1.60	1.56
Madison	2.44	2.43	2.41	2.39	2.36
Meagher	2.59	2.55	2.50	2.44	2.36
Mineral	2.42	2.39	2.42	2.46	2.45
Missoula	2.38	2.36	2.34	2.35	2.34
Musselshell	2.41	2.36	2.28	2.21	2.13
Park	2.45	2.44	2.43	2.42	2.41
Petroleum	2.27	2.21	2.14	2.03	1.91
Phillips	2.36	2.33	2.33	2.35	2.34
Pondera	2.54	2.50	2.43	2.42	2.40
Powder River	1.99	2.01	2.01	2.06	2.09
Powell	2.57	2.49	2.39	2.34	2.27
Prairie	1.86	1.87	1.85	1.80	1.77

COUNTY	1980	1985	1990	1995	2000
Ravalli	3.41	3.49	3.56	3.64	3.71
Richland	2.02	1.95	1.90	1.87	1.82
Roosevelt	2.08	2.04	2.00	1.98	1.95
Rosebud	2.22	2.23	2.23	2.26	2.28
Sanders	2.37	2.26	2.16	2.10	2.03
Sheridan	1.86	1.79	1.74	1.70	1.62
Silver Bow	2.63	2.56	2.49	2.46	2.40
Stillwater	2.56	2.43	2.32	2.24	2.13
Sweet Grass	1.99	1.97	1.95	1.93	1.92
Teton	2.44	2.44	2.44	2.44	2.44
Toole	1.68	1.66	1.64	1.62	1.58
Treasure	2.31	2.14	2.03	1.96	1.87
Valley	2.39	2.38	2.38	2.40	2.41
Wheatland	1.97	1.98	1.98	1.97	1.96
Wibaux	2.27	2.27	2.24	2.20	2.17
Yellowstone	2.10	2.10	2.11	2.13	2.13

Source: Derived

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* Population multipliers were not used for this county.

Teton counties required special adjustment. The adjustments were based on an analysis of the population-to-employment ratios for the periods of 1960-1970 and 1970-1975. This analysis showed either increasing or constant ratios for the counties in question. The original decreasing multipliers were recomputed accordingly.

One county, Jefferson, required a more extreme departure from the multiplier methodology. The relationship between employment and population in Jefferson County has been rather loose in recent years, as a result of the northern part of the county becoming a "bedroom community" for Helena (Lewis and Clark County). Because of this, an alternate projection methodology was used that involved using a previously published 1980 population projection[9] and tying subsequent Jefferson County growth to that of Lewis and Clark County.

Table 3.7 presents county level population projections for the period 1980-2000. As was the case for employment, the state's urban counties accounted for almost 90 percent of the population growth.[10] Most of the small counties (population under 7500) were projected to have declining population. These counties showed larger population declines as compared with employment decreases because of falling population multipliers. As before, most of the remaining medium-sized counties (up to 40,000 population) displayed moderate growth.

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[9] Richard Dodge, Montana Population Projections with County Projections by Age and Incorporated City Projections: 1975-2000 (Helena, Montana: Department of Community Affairs, 1977), p. 27. The projections in this publication were based on a cohort model and historical migration patterns. They represent a purely demographic approach.

[10] The exception to this statement was Silver Bow County, which showed a slight population decline.

TABLE 3.7

MONTANA COUNTY POPULATION PROJECTIONS: 1980 - 2000
(rounded to nearest 100)

COUNTY	1980	1985	1990	1995	2000
Beaverhead	8,200	8,200	8,200	8,200	8,300
Big Horn *	11,400	12,400	13,400	13,900	14,900
Blaine	6,700	6,600	6,500	6,500	6,400
Broadwater	3,100	3,100	3,100	3,100	3,100
Carbon	8,900	9,200	9,700	10,200	11,000
Carter	1,800	1,800	1,700	1,600	1,500
Cascade	85,600	89,000	93,000	97,300	101,400
Chouteau	6,300	6,200	6,100	5,900	5,800
Custer	13,100	13,400	13,500	13,700	13,900
Daniels	3,100	2,900	3,700	3,600	3,400
Dawson	11,200	11,200	11,200	11,400	11,600
Deer Lodge	13,500	13,300	13,000	12,700	12,400
Fallon	4,100	4,100	4,100	4,100	4,100
Fergus	13,300	13,300	13,300	13,400	13,600
Flathead	48,900	52,500	55,600	58,600	62,100
Gallatin	40,200	43,700	46,300	48,900	51,700
Garfield	1,800	1,800	1,800	1,700	1,600
Glacier	11,200	11,300	11,600	11,900	12,100
Golden Valley	1,000	1,000	900	900	900
Granite	2,700	2,800	2,800	2,800	2,800
Hill	18,200	18,700	19,200	19,800	20,300
Jefferson	7,300	8,000	8,200	9,400	10,200
Judith Basin	2,700	2,600	2,400	2,300	2,200
Lake	18,000	18,500	18,900	19,400	20,000
Lewis & Clark	40,900	44,900	48,800	52,800	57,500
Liberty	2,500	2,400	2,300	2,300	2,200
Lincoln *	17,900	18,100	18,300	18,600	17,500
McCone	2,600	2,600	2,500	2,400	2,300
Madison	5,700	5,800	5,800	5,700	5,700
Meagher	2,300	2,300	2,300	2,300	2,300
Mineral	3,700	3,800	3,900	4,000	4,100
Missoula	69,500	74,100	78,300	83,600	89,000
Musselshell	4,400	4,600	4,600	4,600	4,600
Park	12,800	13,100	13,500	13,800	14,200
Petroleum	700	600	600	500	500
Phillips	5,500	5,300	5,200	5,200	5,100
Pondera	7,100	7,000	6,800	6,700	6,600
Powder River	2,600	2,600	2,600	2,600	2,600
Powell	8,000	8,200	8,300	8,500	8,600
Prairie	1,800	1,800	1,700	1,700	1,600

TABLE 3.7 - Continued

MONTANA COUNTY POPULATION PROJECTIONS: 1980 - 2000
(rounded to nearest 100)

COUNTY	1980	1985	1990	1995	2000
Ravalli	20,500	21,400	22,700	23,800	25,000
Richland	10,400	10,300	10,200	10,100	10,000
Roosevelt	10,700	10,900	11,100	11,300	11,500
Rosebud	10,100	11,100	11,100	11,200	11,300
Sanders	8,600	8,700	8,900	9,200	9,400
Sheridan	5,400	5,200	5,200	5,100	5,000
Silver Bow	40,900	40,700	40,500	40,500	40,500
Stillwater *	5,500	5,400	6,800	6,500	6,200
Sweet Grass *	3,300	3,200	3,700	3,700	3,600
Teton	6,300	6,300	6,200	6,100	6,100
Toole	5,300	5,400	5,400	5,500	5,500
Treasure	1,200	1,100	1,000	900	800
Valley	13,300	13,100	13,000	12,900	12,900
Wheatland	2,500	2,500	2,500	2,400	2,400
Wibaux	1,500	1,500	1,500	1,400	1,300
Yellowstone	109,700	123,500	136,400	150,000	164,400
TOTAL	785,500	823,100	860,400	897,200	935,000

SOURCE: Derived

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* Total population includes temporary construction workers and families. Population without this component is as follows: Big Horn - 11,100 (1980), 12,200 (1985), 13,200 (1990); Lincoln - 16,500 (1980); Stillwater - 5,200 (1985); and Sweet Grass - 3,100 (1985).

CHAPTER 4

COMPARISON OF POPULATION PROJECTIONS

This chapter contains a comparison of the projections presented in Chapter 3 with those recently constructed by the Bureau of Economic Analysis (BEA), U. S. Department of Commerce.[1] These latter projections were computed by BEA for the Office of Water Program Operations, U. S. Environmental Protection Agency. The comparison will be in terms of total statewide population for the period of 1980-2000. Included in the comparison will be an analysis of possible upward or downward biases in the methodologies that produced the projections, and a judgment as to the reasonableness of each set of projections.

4.1 General Comparison of the Projections

Projections produced by the MASS system differ substantially from the BEA estimates. Table 4.1 presents the two sets of projections for the period

TABLE 4.1

COMPARISON OF BEA AND MASS PROJECTIONS FOR MONTANA: 1980-2000
(rounded to nearest 1000)

	1980	1985	1990	1995	2000
MASS	786,000	823,000	860,000	897,000	936,000
BEA*	767,000	774,000	780,000	N/A	802,000

Sources: Derived, and Bureau of Economic Analysis

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[1] Bureau of Economic Analysis, U. S. Department of Commerce, "Population, Personal Income, and Earnings, By State, Projections to 2000", October, 1977.

* BEA adjusted an original set of projections for a 1970 Census underenumeration of approximately 2.5 percent nationwide to arrive at the above population estimates. To be strictly comparable, the MASS numbers should be adjusted upward also.

of 1980-2000. As can be seen from Table 4.1, the BEA projections are much more conservative than the ones produced by MASS. Because of the wide differences in the two sets of projections, an analysis of methodologies becomes relevant.

4.2 BEA Projection Methodology

The BEA projections methodology for Montana[2] can be summarized using the following equation.[3]

$$MT\ POP = \frac{MT\ PI}{MT\ PCI} = \frac{MT\ PI}{a\ (US\ PCI)}$$

where:

MT POP = Montana Population
MT PI = Montana Personal Income in constant dollars
MT PCI = Montana Per Capita Personal Income in constant dollars
US PCI = United States Per Capita Personal Income in constant dollars
a = fraction that MT PCI is of US PCI, i.e., MT PCI/US PCI

Thus, population for Montana is projected higher for larger Montana personal income forecasts, lower for higher U.S. per capita income projections, and lower the closer that projected Montana per capita income is to its national counterpart.

The basic reason why the Montana BEA projections for 1980 and beyond were so conservative was that U.S. per capita personal income appears to have been overestimated. This in turn was primarily the result of an overoptimistic projection of U.S. personal income. Taking the case of 1980, U.S. per capita personal income in constant dollars must grow at a 6.7% rate of increase from

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[2] The same procedures were applied by BEA to all states.

[3] Bureau of Economic Analysis, "Population, Personal Income, and Earnings", p. 11.

the latest estimate for 1977 of 897.4 (billion $ 1967)[4] to reach the BEA projected 1980 level of 1,089.9 (billion $ 1967). This rate of increase is completely implausible, given the historical growth rate for U. S. personal income and other projections of real 1980 personal income.[5] It appears that the same problem exists in BEA projections of U. S. per capita personal income for years beyond 1980 also.

The apparent overestimation of U. S. personal income and per capita income was partially, but by no means wholly, offset by a companion overprojection of Montana personal income. As was the case for U. S. personal income, this is the most obvious for 1980. To achieve the 1980 BEA personal income projection for Montana, real personal income must grow at an annual growth of 5.6% from its estimated 1977 level of 2,787,285 (thousands of $ 1967)[6], or 4.5% from the 1975 level of 2,644,464 (thousands of $ 1967). Both rates are well above the Montana historical growth rate of 3.7%.[7]

In addition, the Montana population projections would have been even more conservative if the Bureau of Economic Analysis had not adjusted the forecasts for underenumeration in recent Censuses of Population. This adjustment resulted in increasing the Montana 1980 projection from 758,000 to 767,000, with more

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[4] This estimate was computed by the Research and Information Systems Division of the Montana Department of Community Affairs based on a rate of increase in U. S. personal income measured in constant 1972 dollars.

[5] For example, the historical growth rate for 1960-1970 was 4.9% and Chase Econometric Associates, Inc. forecasts an average growth rate for 1977-80 of less than 4%.

[6] Computed by the Research and Information Systems Division, Montana Department of Community Affairs.

[7] This rate is for the 1960-1975 period.

modest increases in later years of the projection period.

4.3 MASS Projections Methodology

The MASS population projection methodology was extensively discussed in previous chapters. That discussion will not be repeated here. However, several aspects of the methodology merit treatment as they may have contributed to a possible upward or downward bias in the MASS projections. These aspects or factors are: (1) no use of an adjustment mechanism for Census undercount, (2) general underestimation of non-basic employment, (3) use of "Series I" fertility rate projections of the Bureau of the Census, and (4) use of 1970-1975 historical economic data.

The first two factors tend to cause the MASS projections to fall below those constructed by the Bureau of Economic Analysis. As mentioned above, the Census undercount adjustment procedure increased the BEA projections. Thus, since the MASS projections did not include a similar adjustment, they tend to be lower than equivalent BEA population estimates, other things being equal. The second factor, the underestimation of non-basic employment using the MASS system, merits fuller explanation.

Non-basic employment was derived in MASS principally by multiplying basic employment by non-basic employment multipliers. These multipliers or ratios have increased historically. For instance, the overall average of the county and sector specific ratios increased from 1.69 in 1970 to 2.04 in 1975. The MASS methodology included a procedure for adjusting non-basic multipliers over the projection period based on changes in the labor supply factors of labor force participation rates and the natural increase working age population. It appears that the labor force participation rate inputs into this procedure

caused a downward bias in the estimation of non-basic employment. The 1980 MASS estimate of Montana trade and services employment (the major portion of non-basic employment statewide) was virtually identical with a recently published 1977 figure.[8] Incidentally, this 1977 estimate excluded employment in some categories included in the data series[9] used in the MASS model. In addition, the employment growth rate for the trade and service sectors projected by the MASS model for 1980-2000 was only about 1%. This compares with historical growth rates of approximately 3 and 4% for the 1960-1975, and 1960-1977 periods, respectively.[10]

To help counteract this downward bias in non-basic employment projections, "Series I" fertility rate projections were used in the MASS model rather than the more plausible "Series II" estimates. "Series I" projections are higher than "Series II".[11] Other things being equal, the use of the higher fertility rate projections would have caused an upward bias in the MASS population projections. However, because of the problem with non-basic employment, this does not appear to be the case.

The fourth factor influencing the MASS population projections was the use of 1970-75 historical employment data in connection with time trend projections for basic industries. As indicated in previous chapters, these trends were adjusted using data from other sources, along with professional judgment. Never-

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[8] Employment Security Division, Department of Labor and Industry, Montana Employment and Labor Force, Vol. 8, No. 3, March 1978.

[9] Regional Economic Information System (REIS), Bureau of Economic Analysis, U. S. Department of Commerce.

[10] Computed from the Employment Security Division's data series. The REIS data series available for 1967-1975 showed a growth rate of 3.5%.

[11] "Series II" projections assumed an ultimate fertility level of 2.1 average lifetime births per woman.

theless, the 1970-75 data served as the basis for the projections for primary or basic industries.

Total basic employment in Montana historically has remained relatively stable, sometimes showing small declines, depending on the period under analysis and the particular industrial classification scheme used to define basic employment. The 1970-1975 period showed a slightly slower rate of decline of .3%, compared with .4% for 1960-75.[12] Final projections of basic employment for 1980 and 2000 displayed modest increases in basic activity over the 1975 level. This slight reversal of the long-term trend in basic employment was chosen in part to compensate for the apparent underestimation of non-basic employment discussed above.

4.4 Conclusions

Because population projections are used for planning purposes, the question of reasonableness of the projections is very important. This final subsection will address this question. In judging the reasonableness of the projections a discussion of the net effect of the factors reviewed above is relevant. For 1980 projections, the 1977 population estimate published by the U. S. Bureau of the Census is useful comparison information also.

The net bias of the BEA projections seems to be downward. This is clear from a review of section 4.2. In addition, the 1977 Montana population esti-

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[12] Computed from data supplied by the Montana Employment Security Division for sectors defined in the MASS model as basic statewide. The data base did not include military employment which has declined in recent years.

mate[13] of 761,000 is higher than the original BEA 1980 projection[14] of 758,000, (without adjustment for 1970 Census undercount). Incidentally, the 1977 estimate was not adjusted upward to counteract 1970 Census undercount problems. All in all, the 1980 BEA projection appears to be unreasonably low. BEA projections to the year 2000 also appear to be low, since the annual growth rate over the projections period of 1980-2000 is only .2%. This rate is even less than the Montana historical rate for 1960-70, a period of unusual net out-migration.

The net effect of the several factors discussed above in connection with the MASS methodology is clearer for employment than for population. To meet the 1980 MASS projection, total employment will need to grow at an annual rate of 1.5% between 1975 and 1980.[15] Employment in Montana grew at an annual rate of 1.8% for the period of 1967-1975.[16] In addition, the annual growth rate 1980-2000 implicit in the MASS employment projection is only 1%. Thus, employment appears to be understated, especially for years late in the projection period. On the other hand, the MASS population projections appear to be more reasonable, although the 1980 estimate may be high. To reach the projected 1980 level of 786,000 will require an annual growth rate of 1.1% between 1977

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[13] U. S. Department of Commerce News, "Census Bureau Releases 1977 State Population Estimates --- Trends of Early Decade Appear To Be Continuing", January 23, 1978 (news release).

[14] Bureau of Economic Analysis, "Population, Personal Income, and Earnings" Analytic Package, Table 10.

[15] Computed from REIS data.

[16] Computed from REIS data.

and 1980.[17] This compares with an average rate of 1.3% for 1970-1977.[18] However, the yearly population growth rate has been declining in the 1970's, assuming no errors in the year-to-year estimates of population. If this trend continues, the 1980 estimate of population produced by the MASS model will be high, maybe by 5-10 thousand. Whether or not the trend will continue remains to be seen. The population projection for 2000 appears reasonable. The required annual growth rate between 1980-2000 to reach the projected level of 936,000 is about .9%. This compares favorably with a rate of .8% for 1950-1970.[19]

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[17] Computed using the 1977 Bureau of the Census estimate.

[18] Computed from Bureau of the Census estimates. Actual data was obtained in unpublished form from the Bureau of Economic Analysis.

[19] Computed from Bureau of the Census data reproduced in Montana Population Estimates: 1950-1975 (Helena, Montana: Department of Community Affairs, 1976). Substantial outmigration occurred during this 1950-70 period, especially during the 1960's. This phenomenon was reversed for 1970-1977.

APPENDIX A

USER'S MANUAL FOR MASS

1.0 Introduction

This manual is intended to acquaint the reader with the use of the Montana Alternative Simulation System (MASS). The background and conceptual structure of the model are briefly discussed before the physical process of interacting with the MASS is described. If more detailed information on the workings of the MASS model is needed, contact the Research and Information Systems Division of the Department of Community Affairs in Helena, Montana.

2.0 Summary of the MASS Model

The basic purpose of the MASS model is to provide county specific population projections through the year 2000. This is done in five distinct phases:

1) Current population is survived forward for each county individually in single year increments, using a cohort survival algorithm. This process uses modified Bureau of the Census projections of fertility and survival rates. The result of this step is projected "natural increase" population. That is, a projection of what level the population should reach if no net migration occurs.

2) Basic employment levels are projected by year for each county. This is accomplished by using trend analysis, planned industrial employment changes and professional judgment. This results, then, in a "baseline" projection of basic employment.

3) Non-basic employment levels for each county are now calculated for each projection year by multiplying the county specific basic employment projection (obtained in Step 2) and a non-basic multiplier. This

multiplier reflects changes in labor force participation rates and the working age population over the projections period.

4) Total employment is calculated by adding the basic and non-basic employment projection components together.

5) Projected population is then determined by forming the product of total employment and a population multiplier. Both total employment, produced by Step 4 above, and the population multiplier mentioned here are county specific.

3.0 Altering MASS Population Projections

The basic design of MASS allows the user to interact with the process in two places. First, one can choose one of three alternate sets of projected birth rates and, second, one may alter basic employment projections for any county.

In the first case, if one chooses the highest set of birth rate projections, the result will be the largest natural increase population. This, in turn, will cause the non-basic employment multiplier to be the highest level and, therefore, creates the largest non-basic employment component. The resulting total projected population will then be larger than the projected population which results when lower birth rates are used.

In the second case, altering basic employment will cause the total projected population to vary in the same direction as the basic sector(s) were varied. For example, if one increases basic employment in a particular county, the non-basic employment component will also rise. This, in turn, will force the total projected population to be higher.

More specifically the steps in altering MASS are as follows:

1) Choosing a Bureau of the Census birth rate projection series.[1]

2) Determining which basic employment sector(s) to change. Table A-1 shows which sectors that are 100% basic for every county. Users wishing to change one of the mixed basic/non-basic sectors should consult with the economist in charge of MASS. For both cases, it is necessary to specify both levels and timing (in years) of basic employment changes.

3) Contacting the Research and Information Systems Division of the Montana Department of Community Affairs to implement the changes; specifically, the economist in charge of MASS. The division's telephone number is (406) 449-2896.

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[1] U. S. Bureau of the Census, Current Population Reports, Series P-25, No. 601, "Projections of the Population of the United States: 1975 to 2050", (Washington, D. C.: U. S. Government Printing Office, 1975), pp. 21-25, 126

TABLE A-1

SECTOR CLASSIFICATION SCHEME*

BASIC	MIXED BASIC/NON-BASIC
Agriculture	General Construction
Metal Mining	Heavy Construction
Oil and GAs Extraction	Special Trade Construction
Coal and Other Mining	Printing and Publishing
Lumber and Wood Products	Other Transportation
Primary Metals Processing	Utilities and Communication
Other Durable Goods Manufacturing**	Wholesale Trade
Food Processing	Retail Trade
Petroleum Refining	Finance, Insurance, and Real Estate
Other Non-Durable Goods Processing***	Services
Railroad Transportation	Federal-Civilian
Federal-Military	State and Local Government
	Non-farm Proprietors****

Source: Derived

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* This is identical with Table 3.4, presented in Chapter 3.

** Other Durable Goods Manufacturing consists of Furniture and Fixtures; Fabricated Metal Products; Machinery, except Electrical; Electric and Electronic Equipment; Transportation Equipment; Ordnance; Stone, Clay, and Glass Products; Instruments and Related Products; and Miscellaneous Manufacturing Industries.

*** Other Non-Durable Goods Processing includes Textile Mill Products, Apparel and Other Fabricated Textile Mill Products, Paper and Allied Products, Chemicals and Related Products, Rubber and Miscellaneous Plastic Products, Leather and Leather Products.

**** Non-Farm Proprietors consists of all non-agricultural self-employment persons, including independent professional practitioners and entrepreneurs in non-farm businesses. This separate category is required because of data limitations.

APPENDIX B

INCORPORATED CITY AND TOWN PROJECTIONS

This appendix contains population projections for incorporated Montana cities and towns for the period 1980 to 2000. The basic method used was to start with the county projections presented earlier in this report, and then allocate to cities and towns an estimated share that their populations bear to that of the county. For purposes of this exercise, share coefficients were assumed constant over the projection period. They were chosen from the following set of five possible values:

1. The trended city's share using data for 1950, 1960, 1970, 1975 or 1976 (The trend was usually linear.)
2. The average of the 1960 and 1970 shares
3. The 1970 share coefficient
4. The 1975 share
5. The 1976 percentage

For each city or town, the particular coefficient was chosen on the basis of the reasonableness of the 1980 projection, using the coefficient, compared with its 1976 population estimate computed by the U. S. Bureau of the Census (unpublished preliminary data). In some cases, this percentage was modified based on additional factors.

Population projections, which are fraught with risk at best, become even more precarious in the case of cities and towns, and those presented in Table B-1 should be used with caution for a couple of reasons. First, it is impossible to predict what areas will be annexed by a given city or town, and yet annexation could substantially alter its future reported population level. Also, mistakes in county projections are reflected in city forecasts as a result of using share coefficients, unless compensating errors occur.

TABLE B-1

INCORPORATED CITY AND TOWN PROJECTIONS: 1980-2000*

	1980	1985	1990	1995	2000
BEAVERHEAD COUNTY	8,200	8,200	8,200	8,200	8,300
Dillon	4,600	4,600	4,600	4,600	4,650
Lima	350	350	350	350	350
BIG HORN COUNTY**	11,400	12,400	13,400	13,900	14,900
Hardin**	3,150	3,400	3,700	3,800	4,100
Lodge Grass	900	1,000	1,050	1,100	1,200
BLAINE COUNTY	6,700	6,600	6,500	6,500	6,400
Chinook	1,800	1,800	1,750	1,750	1,750
Harlem	1,150	1,150	1,100	1,100	1,100
BROADWATER COUNTY	3,100	3,100	3,100	3,100	3,100
Townsend	1,700	1,700	1,700	1,700	1,700
CARBON COUNTY	8,900	9,200	9,700	10,200	11,000
Bearcreek	50	50	50	50	50
Bridger	1,100	1,100	1,200	1,250	1,350
Fromberg	450	450	500	500	550
Joliet	550	600	600	650	700
Red Lodge	2,500	2,600	2,750	2,850	3,100
CARTER COUNTY	1,800	1,800	1,700	1,600	1,500
Ekalaka	600	600	600	550	500
CASCADE COUNTY	85,600	89,000	93,000	97,300	101,400
Belt	700	700	750	800	800
Cascade	700	750	800	800	850
Great Falls	62,500	65,100	67,900	71,050	74,050
Neihart	100	100	100	100	100
CHOUTEAU COUNTY	6,300	6,200	6,100	5,900	5,800
Big Sandy	800	800	800	750	750
Fort Benton	1,850	1,800	1,800	1,700	1,700
Geraldine	350	350	350	350	350
CUSTER COUNTY	13,100	13,400	13,500	13,700	13,900
Ismay	50	50	50	50	50
Miles City	9,700	9,950	10,000	10,150	10,300

TABLE B-1, Continued

INCORPORATED CITY AND TOWN PROJECTIONS: 1980-2000

	1980	1985	1990	1995	2000
DANIELS COUNTY	3,100	2,900	3,700	3,600	3,400
Flaxville	200	200	250	200	200
Scobey	1,550	1,450	2,250	2,200	2,100
DAWSON COUNTY	11,200	11,200	11,200	11,400	11,600
Glendive	6,150	6,150	6,150	6,250	6,400
Richey	400	400	350	350	350
DEER LODGE COUNTY	13,500	13,300	13,000	12,700	12,400
Anaconda	8,550	8,450	8,250	8,050	7,850
FALLON COUNTY	4,100	4,100	4,100	4,100	4,100
Baker	2,650	2,650	2,650	2,650	2,650
Plevna	200	200	200	200	200
FERGUS COUNTY	13,300	13,300	13,300	13,400	13,600
Denton	400	400	400	400	400
Grass Range	200	200	200	200	200
Lewistown	6,800	6,800	6,800	6,850	6,950
Moore	200	200	200	200	200
Winifred	200	200	200	200	200
FLATHEAD COUNTY	48,900	52,500	55,600	58,600	62,100
Columbia Falls	3,300	3,500	3,750	3,900	4,150
Kalispell	16,150	17,350	18,350	19,350	20,500
Whitefish	3,900	4,200	4,450	4,700	4,950
GALLATIN COUNTY	40,200	43,700	46,300	48,900	51,700
Belgrade	1,950	2,150	2,250	2,400	2,550
Bozeman	21,300	23,150	24,550	25,900	27,400
Manhattan	950	1,050	1,100	1,150	1,250
Three Forks	1,450	1,550	1,650	1,750	1,850
West Yellowstone	800	850	950	1,000	1,050
GARFIELD COUNTY	1,800	1,800	1,800	1,700	1,600
Jordan	550	550	550	500	450

TABLE B-1, Continued

INCORPORATED CITY AND TOWN PROJECTIONS: 1980-2000

	1980	1985	1990	1995	2000
GLACIER COUNTY	11,200	11,300	11,600	11,900	12,100
Browning	1,800	1,800	1,850	1,900	1,950
Cut Bank	3,900	3,950	4,050	4,150	4,200
GOLDEN VALLEY	1,000	1,000	900	900	900
Lavina	200	200	150	150	150
Ryegate	300	300	250	250	250
GRANITE COUNTY	2,700	2,800	2,800	2,800	2,800
Drummond	500	500	500	500	500
Philipsburg	1,000	1,000	1,000	1,000	1,000
HILL COUNTY	18,200	18,700	19,200	19,800	20,300
Havre	11,100	11,400	11,750	12,100	12,400
Hingham	250	300	300	300	300
JEFFERSON COUNTY	7,300	8,000	8,200	9,400	10,200
Boulder	1,100	1,100	1,100	1,100	1,100
Whitehall	1,450	1,500	1,550	1,750	1,850
JUDITH BASIN COUNTY	2,700	2,600	2,400	2,300	2,200
Hobson	200	200	200	150	150
Stanford	500	500	450	450	400
LAKE COUNTY	18,000	18,500	18,900	19,400	20,000
Polson	3,000	3,100	3,150	3,250	3,350
Ronan	1,500	1,550	1,550	1,600	1,650
St. Ignatius	900	900	900	900	900
LEWIS & CLARK COUNTY	40,900	44,900	48,800	52,800	57,500
East Helena	2,050	2,250	2,400	2,600	2,850
Helena	27,500	30,200	32,800	35,500	38,650
LIBERTY COUNTY	2,500	2,400	2,300	2,300	2,200
Chester	1,000	950	900	900	850

TABLE B-1, Continued

INCORPORATED CITY AND TOWN PROJECTIONS: 1980-2000

	1980	1985	1990	1995	2000
LINCOLN COUNTY**	17,900	18,100	18,300	18,600	17,500
Eureka	1,050	1,100	1,100	1,100	1,100
Libby**	3,250	3,300	3,350	3,400	3,200
Rexford	150	150	150	150	150
Troy**	1,100	1,100	1,100	1,150	1,050
McCONE COUNTY	2,600	2,600	2,500	2,400	2,300
Circle	1,050	1,050	1,050	1,000	950
MADISON COUNTY	5,700	5,800	5,800	5,700	5,700
Ennis	550	600	600	550	550
Sheridan	750	750	750	750	750
Twin Bridges	750	750	750	750	750
Virginia City	200	200	200	200	200
MEAGHER COUNTY	2,300	2,300	2,300	2,300	2,300
White Sulphur Springs	1,400	1,400	1,400	1,400	1,400
MINERAL COUNTY	3,700	3,800	3,900	4,000	4,100
Alberton	500	500	550	550	550
Superior	1,100	1,100	1,150	1,150	1,200
MISSOULA COUNTY	69,500	74,100	78,300	83,600	89,000
Missoula	31,300	33,300	35,250	37,600	40,050
MUSSELSHELL COUNTY	4,400	4,600	4,600	4,600	4,600
Melstone	250	250	250	250	250
Roundup	2,400	2,500	2,500	2,500	2,500
PARK COUNTY	12,800	13,100	13,500	13,800	14,200
Clyde Park	300	300	300	300	350
Livingston	7,300	7,450	7,700	7,850	8,100
PETROLEUM COUNTY	700	600	600	500	500
Winnett	250	200	200	150	150

TABLE B-1, Continued

INCORPORATED CITY AND TOWN PROJECTIONS: 1980-2000

	1980	1985	1990	1995	2000
PHILLIPS COUNTY	5,500	5,300	5,200	5,200	5,100
Dodson	200	150	150	150	150
Malta	2,300	2,250	2,200	2,200	2,150
Saco	350	350	350	350	350
PONDERA COUNTY	7,100	7,000	6,800	6,700	6,600
Conrad	3,350	3,300	3,200	3,150	3,100
Valier	700	700	650	650	650
POWDER RIVER COUNTY	2,600	2,600	2,600	2,600	2,600
Broadus	750	750	750	750	750
POWELL COUNTY	8,000	8,200	8,300	8,500	8,600
Deer Lodge	5,150	5,300	5,350	5,500	5,550
PRAIRIE COUNTY	1,800	1,800	1,700	1,700	1,600
Terry	900	900	850	850	800
RAVALLI COUNTY	20,500	21,400	22,700	23,800	25,000
Darby	550	550	550	550	550
Hamilton	3,350	3,500	3,800	3,900	4,150
Stevensville	1,300	1,350	1,450	1,500	1,600
RICHLAND COUNTY	10,400	10,300	10,200	10,100	10,000
Fairview	1,000	950	950	900	900
Sidney	4,850	4,800	4,800	4,750	4,700
ROOSEVELT COUNTY	10,700	10,900	11,100	11,300	11,500
Bainville	200	200	200	200	200
Brockton	400	400	400	400	450
Culbertson	850	850	900	900	900
Froid	300	300	300	300	300
Poplar	1,450	1,450	1,500	1,550	1,550
Wolf Point	3,650	3,700	3,750	3,850	3,900
ROSEBUD COUNTY	10,100	11,100	11,100	11,200	11,300
Forsyth	2,100	2,350	2,350	2,350	2,350

TABLE B-1, Continued

INCORPORATED CITY AND TOWN PROJECTIONS: 1980-2000

	1980	1985	1990	1995	2000
SANDERS COUNTY	8,600	8,700	8,900	9,200	9,400
Hot Springs	700	750	750	750	800
Plains	1,200	1,250	1,250	1,300	1,350
Thompson Falls	1,550	1,600	1,650	1,700	1,700
SHERIDAN COUNTY	5,400	5,200	5,200	5,100	5,000
Medicine Lake	350	350	350	350	350
Outlook	100	100	100	100	100
Plentywood	2,300	2,200	2,200	2,150	2,150
Westby	250	250	250	250	250
SILVER BOW COUNTY	40,900	40,700	40,500	40,500	40,500
Butte	22,950	22,850	22,750	22,750	22,750
Walkerville	1,000	1,000	1,000	1,000	1,000
STILLWATER COUNTY**	5,500	5,400	6,800	6,500	6,200
Columbus	1,350	1,300	1,700	1,600	1,550
SWEET GRASS COUNTY**	3,300	3,200	3,700	3,700	3,600
Big Timber	1,850	1,750	2,100	2,100	2,050
TETON COUNTY	6,300	6,300	6,200	6,100	6,100
Choteau	1,650	1,650	1,650	1,600	1,600
Dutton	400	400	400	400	400
Fairfield	650	650	650	650	650
TOOLE COUNTY	5,300	5,400	5,400	5,500	5,500
Kevin	200	200	200	200	200
Shelby	2,900	2,950	2,950	3,000	3,000
Sunburst	550	550	550	550	550
TREASURE COUNTY	1,200	1,100	1,000	900	800
Hysham	600	550	500	450	400

TABLE B-1, Continued

INCORPORATED CITY AND TOWN PROJECTIONS: 1980-2000

	1980	1985	1990	1995	2000
VALLEY COUNTY	13,300	13,100	13,000	12,900	12,900
Glasgow	5,400	5,300	5,250	5,200	5,200
Nashua	600	600	600	600	600
Opheim	350	350	350	350	350
WHEATLAND COUNTY	2,500	2,500	2,500	2,400	2,400
Harlowton	1,350	1,350	1,350	1,300	1,300
Judith Gap	150	150	150	150	150
WIBAUX COUNTY	1,500	1,500	1,500	1,400	1,300
Wibaux	650	650	650	600	600
YELLOWSTONE COUNTY	109,700	123,500	136,400	150,000	164,400
Billings	77,350	87,050	96,150	105,750	115,900
Broadview	100	100	100	100	100
Laurel	7,300	8,200	9,050	9,950	10,900

SOURCE: Derived

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* City and town projections were rounded to the nearest 50, and county control totals to the nearest 100 to eliminate spurious accuracy.

** Total population for some years includes temporary construction workers and families.